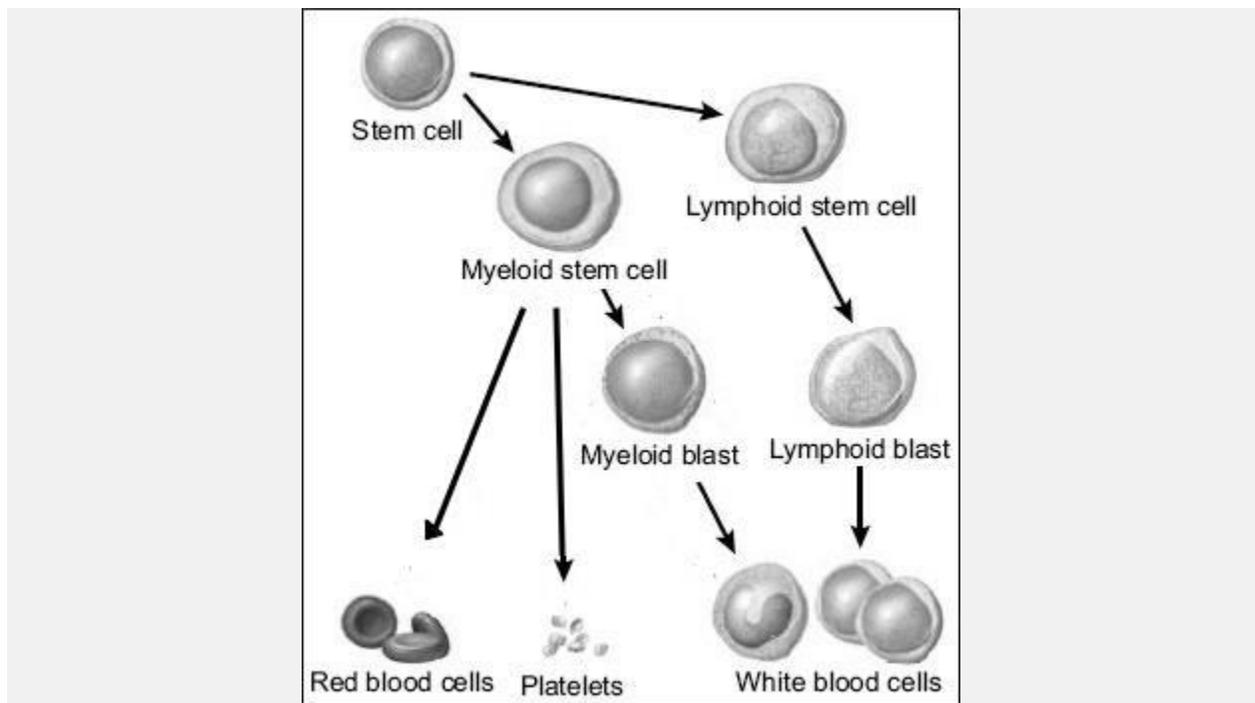


# Bone Marrow



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## Bone Marrow



Bone marrow blood stem cells produce red blood cells, white blood cells, and platelets.

Image Credit: National Cancer Institute (Edited by RB)

## Bone Marrow

Bone marrow is the soft, flexible connective tissue within bone cavities. A component of the lymphatic system, bone marrow functions primarily to produce blood cells and to store fat. Bone marrow is highly vascular, meaning that it is richly supplied with a large number of blood vessels. There are two categories of bone marrow tissue: red marrow and yellow marrow. From birth to early adolescence, the majority of our bone marrow is red marrow. As we grow and mature, increasing amounts of red marrow is replaced by

yellow marrow. On average, bone marrow can generate hundreds of billions of new blood cells every day.

### **Bone Marrow Structure**

Bone marrow is separated into a vascular section and non-vascular sections. The vascular section contains blood vessels that supply the bone with nutrients and transport blood stem cells and mature blood cells away from the bone and into circulation. The non-vascular sections of the bone marrow are where **hematopoiesis** or blood cell formation occurs. This area contains immature blood cells, fat cells, white blood cells (macrophages and plasma cells), and thin, branching fibers of reticular connective tissue. While all blood cells are derived from bone marrow, some white blood cells mature in other organs such as the spleen , lymph nodes , and thymus gland.

### **Bone Marrow Function**

The major function of bone marrow is to generate blood cells. Bone marrow contains two main types of stem cells . **Hematopoietic stem cells** , found in red marrow, are responsible for the production of blood cells. Bone marrow **mesenchymal stem cells** (multipotent stromal cells) produce the non-blood cell components of marrow, including fat, cartilage, fibrous connective tissue (found in tendons and ligaments), stromal cells that support blood formation, and bone cells.

### **Red Marrow**

In adults, red marrow is confined mostly to skeletal system bones of the skull, pelvis, spine, ribs, sternum, shoulder blades, and near the point of attachment of the long bones of the arms and legs. Not only does red marrow produce blood cells, but it also helps to remove old cells from circulation. Other organs, such as the spleen and liver, also filter aged and damaged blood cells from the blood. Red marrow contains hematopoietic stem cells that produce two other types of stem cells: **myeloid stem cells** and **lymphoid stem cells**. These cells develop into red blood cells, white blood cells, or platelets.

**Myeloid Stem Cells** - develop into red blood cells, platelets, or myeloblast cells. Myeloblast cells develop into white blood cells called granulocytes.

\* Red blood cells - also called erythrocytes, these cells transport oxygen to body cells and deliver carbon dioxide to the lungs.

\* Platelets - also called thrombocytes, these cells aid in the blood clotting process.

\* Granulocytes (white blood cells) - include neutrophils, eosinophils, and basophils. These immune cells defend the body against foreign invaders (bacteria, viruses, parasites, etc.).

**Lymphoid Stem Cells** - develop into lymphoblast cells, which produce other types of white blood cells including lymphocytes.

## **Yellow Marrow**

Yellow marrow consists primarily of fat cells. It has poor vascular supply and is composed of hematopoietic tissue that has become inactive. Yellow marrow is found in spongy bones and in the shaft of long bones. When blood supply is extremely low, yellow marrow can be converted to red marrow in order to produce more blood cells.

## **Bone Marrow Disease**

If bone marrow becomes damaged or diseased, it can result in low blood cell production. Bone marrow disease can develop from bone marrow and blood cancers such as leukemia. Radiation exposure, certain kind of infections, and diseases such as aplastic anemia and myelofibrosis can also cause blood and marrow disorders. These diseases compromise the immune system and deprive organs and tissues of the life giving oxygen and nutrients they need. A bone marrow transplant may be done in order to treat blood and marrow diseases. In the process, damaged blood stem cells are replaced by healthy cells obtained from a donor. The healthy stem cells can be obtained from the donor's blood or bone marrow. Bone marrow is extracted from bones such as the hip or sternum. Stem cells may also be obtained from umbilical cord blood to be used for transplantation.

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